Development of NPD Portfolio Management in Project Based Environments

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Abstract. This paper focuses towards examining the initial phases of new product development portfolio management supervising set of projects managed by a company. It also explores the selection of the most suitable projects from a series of candidates through a prioritisation criteria based on the available resources, the strategic objectives and the features of each product within the product lifecycle. Utilising a mixed methodology, the research proposes to develop a novel framework named *project portfolio management practice* (PPMP) within small and mid-sized project-based manufacturing companies, therefore providing a system that helps them increasing their product sales volume by ten-percent and improving the NPD-SCM alignment with PPM. Indeed, more empirical sources should be selected, with the aim of expanding the visions within any given product development environment. This generalisation aims to cover other industries, including manufacturing, service and product based environments to identify the proper measures for any type of project.

Keywords. New Product Development (NPD), Project Portfolio Management (PPM), Project Based Environments, Manufacturing, SCM Integration

1. Introduction

The overall aim and the background of the research is structuring a Project Portfolio Management method that is appropriate for a project-based organization which uses lean and agile methodologies for managing New Product Development (NPD) projects and which operates in different businesses with shared resources. As portfolio management is a well-known discipline, the focus of the Individual Project is the initial phase of selection and validation of project proposals, which has to happen before project planning. This is a phase that requires well-structured collaboration and organisation within marketing tasks (unexpressed consumer needs, positioning with respect to competitors, etc.).

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2. Literature Review

The literature review firstly defines the three key areas of the research: supply chain management (SCM); NPD; project portfolio management (PPM) and NPD portfolio management, which principally covers the initial phase of selection and validation of project proposals. At this point, the review focuses on the alignment of the key areas outlined. To begin with, it explains how and why NPD has become so fundamental within SCM, identifying the role of NPD in SCM, the methodologies adopted to improve the NPD-SCM alignment and the research outcomes. Then, the researcher defines NPD-SCM alignment with PPM, focusing on the selection and development of the right products, and on the coordination and maintenance of the project portfolio. Among all the NPD-SCM practises, the NPD processes of original equipment manufacturing (OEM) is linked with tier-1 suppliers. Identifying the key decision making points, better frameworks might be redesigned to engage all the business aspects [1] and it would be facilitated through portfolio management. Previous research defines that the concept of SCM evolved from the traditional logistics and purchasing functions, consisting in a more general strategic approach that aims to manage distribution and materials [2]. The definitions of SCM found in the literature are numerous and often controversial. For instance, SCM is described as the chain connecting all elements of the manufacturing and supply process, from raw materials to customers, including various business boundaries [3]. However, any definition available is incomplete. Therefore, to further clarify the concept, research studies also propose to divide the several definitions into five SCM schools of thought: functional chain awareness, information, a future perspective, integration, and linkage/logistics [4].

Nowadays, NPD has become a fundamental process for achieving business success. Therefore, managers should rely on the knowledge and information available to implement an efficient NPD, capable of dealing with high product complexity and a dynamic environment, since NPD is a key to product and service innovation in world present business competition. Indeed, Product Development & Management Association (PDMA) claims that, nowadays, 69% of companies have adopted a formal, cross-functional process for NDP [5]. Furthermore, the majority of these firms use a Stage-Gate NPD process, which consists in a conceptual and operational road map that guides the company during the development of new products, dividing it into stages and management decision gates [6].

Earlier research studies suggest the goals that portfolio management should achieve in order to be successful, and identifies the benefits deriving from a well implemented Stage-Gate system or new product process [7]. The first goal in portfolio management consists in maximizing the value or commercial worth of the active portfolio in terms of organizational objectives. The second goal is seeking well-balanced projects by adopting a suitable number of parameters for instance; various timings and risk ratings and within different markets, technologies and product categories. The third goal of NPD portfolio management consists in aligning the portfolio to business strategies. The fourth and last goal that should be achieved, is avoiding pipeline gridlock by developing a portfolio of the right size [7]. Moreover, it is required for the executives to achieve several benefits in NPD by implementing lean manufacturing principles to their organizational structure. While lean management focuses on meeting the customer requirements through standardization and repeatability, portfolio management enhances iteration and wasting resources. To overcome this, the focus should be placed on implementing portfolio management and pipeline management, giving companies the possibility to apply lean

practices more strategically [8]. The sales pipeline is used to monitor potential revenues, manage investment decisions and to frame future projections and hence provide guidance to shareholders and market analysts [9]. Two of the critical aspects of PPM in NPD success are the "Fuzzy Front-End (FFE)" and the allocation of resources. FFE refers to the first stage of the product design and development (PDD) process that companies tend to formulate a product scheme and need to decide whether to make investments for further idea developments [10]. An effective conceptual framework can be utilised by companies in order to design their FFE and to contribute their supply chain practices within the product development operations. The framework has got three main pillars including design requirements, FFE-supplier configuration and supply chain capabilities [10]. Applying guidelines for roles and responsibilities of suppliers to coordinate within the FFE activities, two different approaches are defined comprising Concept Dalliances and Concept Alliances. Whereas, the most effective strategies rely on the level of the innovation of product development while making strategic alliance with suppliers to exploit their potentials in order for generation of value-added products [10].

3. Case Study Analysis

This research has been conducted in collaboration with company XYZ, an Italian B2B mechanical firm specialised in natural and engineered stone plants and machine tools. Company XYZ was founded in 1963 and went through a rapid and international growth thanks to its focus on innovation, research and quality of its products and processes. Initially as a manufacturer of machinery to work natural stone, the company focused on technologies and plants for the production of what was once usually called "agglomerate", since composed of stone fragments bonded together by resins, now known as engineered stone. The company patented the technology under the name XYZ-STONE, and sold the first plant for the production of 125 x 125 cm slabs in 1979. Lately, because of the increasing amount of work, the NPD department started to rely on a network of small external partners, such as design studios and technical consultants, who handle the design of parts of machines that do not involve high strategic relevance. Company XYZ competes in a market where customers demand precise and fast machines and plants. It targets the upper segments of the market and, although the standards can vary depending on the country, customers usually request personalised machines with extremely high quality standards. This means that the lead time for some commissions can be extremely long. It is hard in this industry, especially after the financial crisis, to be able to balance the amount of radical and incremental innovation projects, to predict the market and to manage resources efficiently across activities in order to stay internationally competitive. This is a real challenge for company XYZ, as it is family-owned and partly family-managed company. The company structure is relatively flat, and every unit has to report to the upper management, i.e. ownership, directly. They are the ones who, up until recently, have mostly taken care of producing innovative and creative ideas, but are also very absorbed in the firm's day-to-day business.

3.1 Questionnaire Design & Development

The questionnaire has been useful to interpret and evaluate the PPM model developed against the scope and objectives of the research study. The questions were conducted with people having different roles in the company, in order to facilitate the research with

wider flexibility. The questionnaire were applicable to all levels, including the president and MD, strategic manager, product development manager, sales engineer manager, CAD-CAM development manager, technologist, and the product managers. The key questions developed within the research were:

1) *Which tool/tools has/have resulted more effective for you? Why?*
2) *Which information about the project you implemented have you found hard to find/elaborate?*
3) *Which one/ones of the gates and stages you think has/have the greatest importance in evaluating and prioritising the projects? Why?*
4) *Do you think that the model will be useful to the company? If yes, in which way? In a short or a long term?*
5) *When and how you think the company should introduce the model?*
6) *What you think a product development PPM tool will bring to the company?*
7) *Which do you think are the limits of this tool?*
8) *Have you got any advice to improve the model?*
9) *Do you believe that analysing a project should be made individually or as regards to the others?*

4. Proposed Research Framework

The PPM model proposed in this research provides a product filter to decide which products to prioritise and which to eliminate, therefore allocating the limited resources among the most competitive projects. At the same time, the PPM model provides balance and strategic alignment to the portfolio, containing costs, maximizing the values and increasing the number of successful projects [11]. The model is divided into Stages (blue squares) and Gates (blue diamonds) [6]. The Gates selected for the system are Market Potential and Strategic Contribution, while Product Proposal, Category-Risk and Portfolio Planning represent the Stages. The Stage-Gate system provides an evaluation criterion suitable for the business and strategic goals of the company analysed [11].

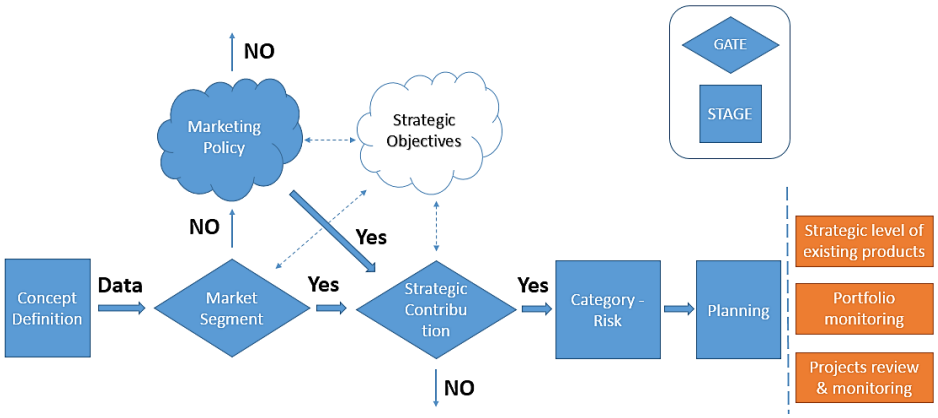

Figure 1. Proposed research PPM framework

The light blue cloud representing Marketing Policy is a secondary Gate. The blue dashed arrows show that a connection is present between the strategic objectives and the linked Gates. Gates are up to the decision "Yes, the project can proceed further" or "No,

the project has to be killed". A successful gating system should provide data integrity and an elimination of the bad projects [7, 12]. Stages, on the other hand, have different functions, such as balancing the portfolio across projects of different kinds and degrees of innovation, prioritising the projects and ensuring an adequate staffing of all NPD project teams.

Each Stage and each Gate presents its own tools, which, in the representation, are listed above or below. The PPM model has been implementing until the Portfolio Planning Stage. After this first set of Stages and Gates, the product development begins, which consists in the yellow squares. These squares represent different level of analysis, which evaluate the strategic level of the products under development, monitoring and, if necessary, reviewing the relative portfolio and single projects. Reviewing means deep modifications in the way the project is considered and developed, or, in the extreme cases, its "death" [13]. The first Stage of the PPM model defines the product concept and outlines its features, such as size specification, material and modular framework, etc. The ***Strategic Objectives*** can be seen as the business drivers that define the directions and target in the PPM process. The ***Category-Risk Stage*** evaluates the type of project and the risks that can impact on its development and launch.

5. Conclusions and Future Research

The scope of this research study consisted in applying PPM methods towards managing NPD projects within different business environments using shared resources. Indeed, the research proposes a PPM method appropriate for small and medium sized project-based manufacturing companies that are incapable of selecting and prioritising suitable NPD projects. The model provides analytical criteria to evaluate the opportunity of developing a product and a prioritisation criteria based on the available resources, the strategic objectives and the product features. The outcome of the research consists in an effective and user friendly method that helps managers to clarify their ideas and opinions among projects, assessing their value and commercial return. Indeed, the research provided to company XYZ with a well-balanced and appropriate portfolio, where projects were adequately staffed and could be monitored through Key Performance Indicators (KPIs). Furthermore, the PPM model offers the possibility to increase the product sales volume, contain costs and improve the NPD-SCM alignment with PPM. The overall learning relies on the fact that a method capable of providing a shared analysis among all the stakeholders; effective in terms of time and results obtained, and an improved efficiency in the product development, fosters the overall awareness and the sharing of the business objectives along with rationality and global competence. Basically, the method proposed supports managers in constructing a shared action line among the entire organization, improving competitiveness in the long term. The research has covered the key objectives for this research; however the research also identified some future research areas from this research.

- The Product Development tools, which evaluate the strategic level of the products under development, monitoring and, if necessary, reviewing the relative portfolio and single projects.
- PPM can be used to implement new strategies capable of originating structural changes. The theory integrates three phases: strategy implementation, organizational information processing and structural adaptation [14].

- Research studies also propose to integrate PPMOs (project portfolio management offices) into different patterns. PPMOs present three roles: the coordinating role, the controlling role and the supporting role. These three roles together handle resource allocation quality, cooperation quality and information quality. Furthermore, PPMOs facilitate control to provide reliable, specific, current and accurate information for the decision-making of project portfolio [15].

The research should be further developed, improving the framework proposed in order to reach a better NPD-SCM alignment with PPM. Indeed, more empirical sources should be selected, with the aim of expanding the visions. This generalisation would cover several industries, identifying the proper indicators and measures for any type of project. Basically, this research acts as a starting point for future researchers, intending to develop new theories and methods in order to further improve PPM and reconfigure the supply chain features on the new products' features.

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